

# EO Detective

Observing the Earth from space

Video: Taking photographs from the  
International Space Station

*Teacher guide*

# Introduction



During his mission to the International Space Station (ISS), Tim Peake shared many spectacular photographs of the Earth. In March 2017, we were given the opportunity to interview him and create a video that would support the EO Detective teaching resources.

Our activities aim to demonstrate how a vantage point in space, such as the ISS, provides a unique perspective from which people can monitor environmental processes and change.

We therefore had a host of questions for Tim, which means that the full interview is 20 minutes long. This guide should help you find the segment or sections that are most relevant to what you are doing.

We have also created a presentation that includes many of the images used in the video. While, for reasons of space, the versions in the presentation are low resolution, the notes for each slide include a link to the original image.

Please share with other teachers how you have used these materials by adding a comment on the appropriate resource or/and on the relevant page of our blog <https://eodetective.wordpress.com/2017/03/29/interviewing-an-astronaut/>

If you have any other questions or feedback, please contact [EODetective@le.ac.uk](mailto:EODetective@le.ac.uk)

Our other worksheets and presentations are available from the European Space Education Resource Office (ESERO) Tim Peake page, which is hosted by STEM Learning. You can go directly to the main EO Detective index at <http://stem.org.uk/cx46j>

Materials by Catherine Fitzsimons (NCEO) funded by NCEO, UK Space Agency and ESA.  
Interview filmed and edited by David Martin, **Impact Media Specialists**.

## Thank you to the following people for their support in producing this resource:

**NCEO/University of Leicester:** Rosie Leigh, Sophie Hebden, John Remedios, Jane Hull

**NCEO/King's College London:** Martin Wooster

**UK Space Agency:** Susan Buckle, Jeremy Curtis, Libby Jackson

**ESA:** Lorraine Conroy, Margherita Buoso and, of course, Tim Peake

**University of Leicester:** Colette Godfrey

**King's College London:** Fenner Holman, Ben Gridley, Francis O'Shea

# The questions



The numbers at the start of each question refer to the time from the start of the video where:

- the question is asked
- the answer begins
- the answer ends.

## Introduction

1. *00:28–0:40–01:16*

We all enjoyed your tweets and pictures and now enjoying the book. Some astronauts don't take (or at least don't use social media to share) their photographs. Why did you choose to do so?

## Practicalities

2. *01:16–01:34–2:10*

Some of these cameras have very long lenses, but no longer than you might see on a sports reporter's camera. Are they modified in any way for taking pictures of the Earth from Space?

3. *02:10–02:18–02:53*

What about the settings you use?

4. *02:53–03:32–04:15*

When we ask visitors to our stand at events what they think might make it difficult to take a picture of the Earth from space difficult, they nearly always say 'no gravity.' What are the actual problems?

5. *04:15–04:30–05:06*

Obviously cloud cover affects the photos you can take – although they make spectacular images in their own right – but what other things can make it difficult to get a photograph of a particular target?

6. *05:06–05:16–05:45*

If there's something you particularly want to photograph, can you sneak away from work to do it – or get it built into your timetable in some way? Or do you just have to hope that you have some free time that corresponds to a good pass?

7. *05:45–05:49–06:09*

Which of your photographs of the Earth is your favourite? Why?

## ISS EO programme



8. [06:09–06:30–06:50](#)  
We tend to think about EO in terms of satellites, like the ESA Copernicus Sentinels and American Landsat, but there is an ISS EO program too – it's how we were able to submit the requests of our competition winners. When/why do scientists want ISS pictures rather than or as well as satellite images?
9. [06:50–06:56–07:26](#)  
How is taking these pictures different to taking those you take for fun?
10. [07:26–07:41–08:22](#)  
What support do you get from the ground when taking these?
11. [08:22–08:48–09:25](#)  
Your internet connection is rather slow, I believe. How are all of the images on the Gateway to Astronaut Photography of Earth, or a sequence used for time-lapse, sent back? Is there a separate channel? Do they have to go overnight?



## Uses of EO

12. [09:30–09:44–10:36](#)  
You shared shots of some spectacular images of natural formations. Was there any natural feature or environment that took you by surprise?
13. [10:37–10:47–11:42](#)  
You mentioned being able to tell spring was coming. What sort of signs were there of that?
14. [11:43–11:48–12:22](#)  
Apart from fields of rapeseed in the spring, were there any other crops or types of agriculture that you were able to recognise?



15. [12:22–12:29–12:58](#)  
What about other human impacts on the environment? Were there any that particularly shocked or surprised you – either by how visible or invisible they were?
16. [12:58–13:22–13:35](#)  
Now we have over 30 years of more or less continuous satellite imagery of the earth & it is very helpful for monitoring change. You were only there for a short period of time, but did you see any evidence of changes – natural or man-made – that stood out?
17. [13:35–13:44–14:24](#)  
What about weather systems? Were you able to watch those develop? What
18. [14:24–14:48–15:25](#)  
EO is used for disaster prevention and response: flood management or monitoring fires for example. You shared pictures of floods in the North of England and a huge fire in Canada, as well as Etna. How does it feel watching something like that unfold from space rather than reading about it or seeing it on the news?
19. [15:34–15:47–16:23](#)  
Which of the photos you took do you think is the most revealing/useful/important? Why?

## Particular pictures

20. [16:24–16:35–17:15](#)  
Tell us about the iceberg. Were you expecting to see it again?
21. [17:15–17:26–17:50](#)  
Thomas Pesquet joked about his #pyramidfail. Is there anywhere you hoped to see/snap that you didn't catch?
22. [17:51–17:58–18:40](#)  
You've said Patagonia is a place you enjoyed photographing – why?
23. [18:41–18:45–19:23](#)  
Is there anything else you would like to tell us about seeing the Earth from Space?
24. [19:23–19:25–19:29](#)  
And has your geography improved?

## Additional resources and materials



### Astronaut photographs

Tim Peake's photographs are available on flickr

<https://www.flickr.com/photos/timpeake/> as are those of other ESA astronauts such as Thomas Pesquet [https://www.flickr.com/photos/thom\\_astro/](https://www.flickr.com/photos/thom_astro/) and Alexander Gerst [https://www.flickr.com/photos/astro\\_alex](https://www.flickr.com/photos/astro_alex)

Tweeted astronaut photographs – and some untweeted ones – are mapped by students of Dave MacLean at COGS/NSCC in Canada. At the time of writing, the latest version was

[http://www.arcgis.com/apps/PublicInformation/index.html?appid=48d4530ad1ca47bd\\_a12a55c78b41b9d7](http://www.arcgis.com/apps/PublicInformation/index.html?appid=48d4530ad1ca47bd_a12a55c78b41b9d7) and the sidebar contains links to earlier ones. Many of the pins are also linked to a higher resolution version of the image as well as the original tweet.

The primary source for astronaut photographs of Earth is *NASA's Gateway to Astronaut Photographs of Earth* <http://eol.jsc.nasa.gov/SearchPhotos/>. These photographs can be used for educational purposes free of charge.

### Satellite images

Both ESA and NASA have regularly updated Earth Observation image sites where they publish interesting and often spectacular, images of Earth, with commentaries. These are at

[http://www.esa.int/spaceinimages/Sets/Earth\\_observation\\_image\\_of\\_the\\_week](http://www.esa.int/spaceinimages/Sets/Earth_observation_image_of_the_week) and <http://earthobservatory.nasa.gov> respectively. Once again, you can download and use the images for educational purposes free of charge.

Data from Landsat satellites has been publicly available for a long time from two US Geological survey websites: EarthExplorer (<http://earthexplorer.usgs.gov>) and Global Visualization Viewer, or GloVis (<http://glovis.usgs.gov>). The latter is, perhaps, more intuitive but can be rather slow to load. Images & data from both can be used for educational purposes free of charge, but you do need to register.

Higher-resolution (therefore covering smaller areas) data from Copernicus Sentinel satellites is available but high demand and large file size means most sites are really aimed at specialist users. Try exploring <http://apps.sentinel-hub.com/sentinel-playground> - again you are free to use images created using this app for educational purposes, but you should acknowledge both source and program e.g. 'Contains modified Copernicus data [year] processed using Sentinel Playground'.

# What is Earth Observation?

Earth Observation (EO) scientists collect information about the Earth – the land, the sea and the atmosphere – using sensors carried on satellites, aircraft, ships, buoys floating on the ocean and thousands of weather stations around the world. There is now a great deal of data available and scientists are finding more and more ways to use it to study our planet and make predictions about its future.



## What is it used for?

### Weather and climate

We are all familiar with satellite images from weather forecasts. But satellite instruments can do more than show where clouds and weather systems are. They can give all sorts of information such as land and sea temperature, wind speed and rainfall. Meteorologists need this data from all around the world to build computer models that they use to make their weather forecasts. Climate scientists also use this data: their focus is investigating longer-term patterns and changes to the Earth's natural systems.



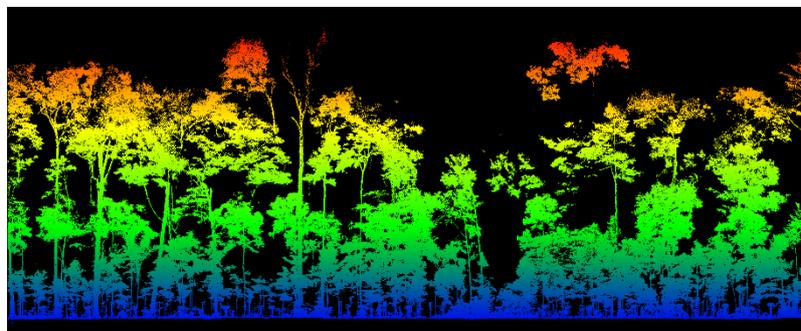
### Ocean temperature and colour



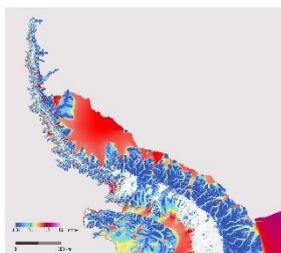
The ocean plays an important part in controlling climate. Using satellite data we can map the temperature of the entire ocean at frequent intervals to see how heat is moving around the planet. Satellites such as ESA's Sentinel 3 are very sensitive to changes in colour caused by the presence of plankton: this is another important input into climate models.

### Forests and habitats

Satellite images show large areas of the Earth's surface at one time, making it easier to spot changes such as deforestation caused by illegal logging. It is now also possible to measure the density of trees, and therefore the



amount of carbon they capture and store, using remote sensors. This means climate scientists can keep better tabs on how carbon flows around the planet, and give the government better information to help it keep international carbon treaties.



### Ice

Satellites such as Sentinel-1A & 1B use 'active sensing' techniques, similar to radar, to help monitor not just the extent of ice in glaciers and at the poles, but also the ice thickness and how fast it moves.



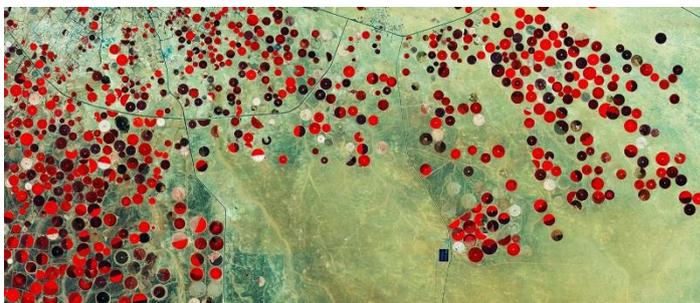
## Natural disasters

Active sensors also allow scientists to map ground and sea level height with great sensitivity. Since satellites can scan places that are otherwise inaccessible, information from them is used to monitor environmental changes during forest fires, earthquakes, volcanoes, floods and so on and is now a crucial tool for emergency services and rescue teams.



## Human activity and impact

EO data is used in many ways to support businesses and explore our impact on the Earth. For example, it can be used to monitor air quality and other forms of pollution such as effluent from industry and light from cities. The mining and oil industries use it to identify sites that might contain new mineral or oil reserves. Farmers use it to monitor the health of



their crops and to irrigate and fertilise only those plants that need it. Of course, this 'precision agriculture' also makes use of accurate weather forecasts and, when combined with climate data, it has potential to increase long-term food security in many parts of the world.

## What is the role of NCEO?

The National Centre for Earth Observation (NCEO) brings together scientists leading many of these fields and supports efforts to process, analyse and share the vast amounts of data now available. We provide training and access to instruments. NCEO is a research centre of the UK's Natural Environment Research Council (NERC), which recognises that we can advance UK research into the Earth's natural systems more effectively by working together. Our network of expertise includes academics, engineers, industry partners and space agencies, including the UK Space Agency. We are involved in planning new satellite missions and link to international organisations such as the European Space Agency (ESA) and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT).



*We are passionate about the importance of our research to society; EO science is increasingly beneficial for a range of applications.*

**Professor John Remedios,**  
*Director of NCEO*